

CLAIM AMENDMENTS

Please cancel, amend, and add new claims as follows:

C L A I M S

1. (Currently amended) A process for controlling the performance of a homogeneous charge compression (HCCI) engine in a vehicle having a hydrocarbon fuel reservoir ~~which process comprises~~ comprising adjusting the octane or cetane number of hydrocarbon fuel being supplied to the HCCI engine by:

- (a) converting a portion of hydrocarbon fuel from the hydrocarbon fuel reservoir to synthesis gas;
- (b) converting synthesis gas produced in step (a) to a mixture of hydrocarbons having an octane number less than or a cetane number higher than that of the hydrocarbon fuel of the hydrocarbon fuel reservoir using a Fischer Tropsch process;
- (c) delivering (i) a portion of hydrocarbon fuel from the hydrocarbon fuel reservoir and (ii) a portion of the mixture of hydrocarbons produced in step (b) to the HCCI engine; and
- (d) varying the amounts of (i) and (ii) in step (c) in order to adjust the octane or cetane number of the hydrocarbon fuel being supplied to the HCCI engine, thereby adjusting the octane or cetane number of hydrocarbon fuel being supplied to the HCCI engine.

2. (Currently amended) A ~~The process of according to claim 1 or claim 2~~ wherein step (a) comprises steam reforming using a source of water or steam, at least part of the said water or steam required for step (a) is obtained by condensing an exhaust gas stream from the engine or vehicle.

3. (Currently amended) A ~~The process according to any one of claim 1 the preceding claims~~ wherein the synthesis gas used in step (b) has a hydrogen gas to carbon monoxide ratio in the range of 0.6 to 2.5 part hydrogen gas for every part carbon monoxide.

4. (Currently amended) A ~~The process according to any one of claim 1 the preceding~~ claims wherein heat of reaction from the Fischer Tropsch process of step (b) is used to:

- (i) provide heat for the reaction of step (a) ~~of claim 1~~; and/or
- (ii) preheat the reactants for the reaction of step (a) ~~of claim 1~~.

5. (Currently amended) A ~~The process according to any one of the preceding claims~~ claim 1 wherein the Fischer Tropsch process in step (b) is followed by a condensing step which produces a light and a heavy fraction and wherein the light and/or the heavy fraction form at least part of the mixture of hydrocarbons in (ii) of step (c) ~~of claim 1~~.

6. (Currently amended) A ~~The process according to~~ of claim 5 wherein the condensing step produces a light fraction and a heavy fraction and at least a part of the light fraction is either

- (a) stored in a pressurised storage container;
- (b) delivered to the HCCI engine; or
- (c) recycled by converting it to synthesis gas in step (a) ~~of claim 1~~.

7. (Currently amended) A ~~The process according to claim 5 or claim 6~~ wherein cooling water for the condensing step is provided by a cooling system for the HCCI engine or vehicle.

8. (Currently amended) A ~~The process according to any one of claim 1 wherein the preceding claims which~~ the process further comprises (e) monitoring the performance of the HCCI engine using a sensor to provide information relating to engine performance and adjusting the octane number or cetane number in response to said information.

9. (Currently amended) A ~~The process according to~~ of claim 8 wherein the sensor is a knock sensor.

10. (Currently amended) A ~~The process according to~~ of claim 8 or claim 9 wherein an engine management chip receives information from the sensor and processes said information to provide data from which the required amounts of (i) and (ii) of step (c) ~~in the process of claim 1~~ can be determined.

11. (Original) A HCCI engine and fuel system comprising

- (a) a fuel reservoir;
- (b) a HCCI engine;
- (c) a reformer for converting hydrocarbon fuel to synthesis gas;
- (d) a reactor for converting synthesis gas to a hydrocarbon mixture using a Fischer Tropsch process;
- (e) means for removing a portion of hydrocarbon fuel from the fuel reservoir and delivering it to the reformer;
- (f) means for removing synthesis gas product from the reformer and delivering it to the reactor;
- (g) means for removing a mixture of hydrocarbons from the Fischer Tropsch reactor and delivering it to the HCCI engine; and
- (h) means for removing a portion of hydrocarbon fuel from the fuel reservoir and delivering it to the HCCI engine.

12. (Currently amended) A The HCCI engine and fuel system ~~according to~~ of claim 11 which further comprises (i) a condenser for converting a hydrocarbon mixture produced by the reactor into a light and a heavy fraction; and the means specified in (g) includes means for removing a portion of the heavy fraction and/or the light fraction produced by the condenser and delivering it to the HCCI engine.

13. (Currently amended) A The HCCI engine and fuel system ~~according to~~ of claim 11 or ~~claim 12~~ comprising (k) a sensor for monitoring the engine's performance.

14. (Currently amended) A The HCCI engine and fuel system ~~according to~~ of claim 13 comprising (l) an engine management chip.

15. (Currently amended) A The HCCI engine and fuel system ~~according to any one of claim~~ claims 11 to 14 which further comprises one or more of:

- (a) a pressurised storage container for storing the light fraction produced by the condenser;

- (b) a trap for removing sulphur from the synthesis gas being fed into the Fischer Tropsch reactor; and
- (c) a hydrogen removal unit for removing hydrogen from the synthesis gas product from the reformer before the synthesis gas is fed to the Fischer Tropsch reactor.

16. (Currently amended) A vehicle comprising the HCCI and fuel system of ~~claims 10 to 15~~ claim 10.

17. (New) A vehicle comprising the HCCI and fuel system of claim 15.

18. (New) The process claim 6 wherein cooling water for the condensing step is provided by a cooling system for the HCCI engine or vehicle.

19. (New) The process of claim 5 wherein the process further comprises (e) monitoring the performance of the HCCI engine using a sensor to provide information relating to engine performance and adjusting the octane number or cetane number in response to said information.

20. (New) The process of claim 9 wherein an engine management chip receives information from the sensor and processes said information to provide data from which the required amounts of (i) and (ii) of step (c) can be determined.